

**IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF OHIO  
EASTERN DIVISION**

WILLIAM HOWE, et al,	)	CASE NO.: 5:06 CV 2779
	)	
Plaintiffs,	)	
	)	
vs.	)	JUDGE ADAMS
	)	
CITY OF AKRON,	)	
	)	
Defendant.	)	

**DECLARATION OF KYLE BRINK, Ph.D.**

1. I am an industrial psychologist and I have personal knowledge of the information and events in this declaration, which I make under penalty of perjury; my curriculum vitae is attached.
2. In preparing this affidavit, I have reviewed the *Final Report: 2004 Promotion Examinations for Lieutenant and Captain for the Akron Fire Department* prepared by EB Jacobs on June 2005 (henceforth referred to as *EBJ*), including all appendices attached thereto; the expert reports by Dr. P. R. Jeanneret and Dr. Rick Jacobs; Dr. Robert Johnson's expert report; data sets provided by EB Jacobs, LLC regarding the promotional examinations; completed rating sheet forms; and depositions of Dr. Jacobs, Dr. Jeanneret and Dr. Johnson.
3. In preparing for this declaration, I also reviewed professional peer-reviewed and non-peer reviewed literature relating to employee selection and statistical methods, *Uniform Guidelines on Employee Selection Procedures* (Equal Employment Opportunity Commission, The Civil Service Commission, The Department of Labor, and The Department of Justice, 1978; henceforth referred to as the *Uniform Guidelines*), *Principles for the Validation and Use of Personnel Selection Procedures* (SIOP, 2003; henceforth referred to as the *SIOP Principles*), and the *Standards for Educational and Psychological Testing* (American Educational Research Association, American Psychological Association, National Council on Measurement in Education, 1999; henceforth referred to as *APA Standards*).

**Correctly Modeling the Promotional Procedure for Adverse Impact Analyses**

4. The correct model for assessing adverse impact for the Fire Lieutenant and Captain promotional procedures is a comparison of candidates who were promoted versus those who were not promoted (including all candidates who took the exam).
5. The Uniform Guidelines state that adverse impact is to be determined based on the overall or total selection process that is used to make a *hiring or promotion* decision. As stated in the Questions and Answers to the Uniform Guidelines:  
  
13. Q. Is adverse impact determined on the basis of the overall selection process or for the components in that process?

A. *Adverse impact is determined first for the overall selection process for each job* [italics added]. If the overall selection process has an adverse impact, the adverse impact of the individual selection procedure should be analyzed. For any selection procedures in the process having an adverse impact which the user continues to use in the same manner, the user is expected to have evidence of validity satisfying the Guidelines. Sections 4C and 5D. If there is no adverse impact for the overall selection process, in most circumstances there is no obligation under the Guidelines to investigate adverse impact for the components, or to validate the selection procedures used for that job. Section 4C. But see Question 25.

14. Q. The Guidelines designate the "total selection process" as the initial basis for determining the impact of selection procedures. What is meant by the "total selection process"?

A. *The "total selection process" refers to the combined effect of all selection procedures leading to the final employment decision such as hiring or promoting* [italics added]. For example, appraisal of candidates for administrative assistant positions in an organization might include initial screening based upon an application blank and interview, a written test, a medical examination, a background check, and a supervisor's interview. These in combination are the total selection process. Additionally, where there is more than one route to the particular kind of employment decision, the total selection process encompasses the combined results of all routes. For example, an employer may select some applicants for a particular kind of job through appropriate written and performance tests. Others may be selected through an internal upward mobility program, on the basis of successful performance in a directly related trainee type of position. In such a case, the impact of the total selection process would be the combined effect of both avenues of entry.

6. The promotion model that was used for both Lieutenant and Captain was a "top-down" selection procedure. Even though the City of Akron has a "rule of three" and may have chosen candidates in an order other than strict top-down selection, the end results was top-down selection; all candidates ranks 1-28 were promoted from the Lieutenant list and all candidates ranks 1-12 were promoted from the Captain list.
7. According to EBJ, the passing score on the both the Lieutenant and Captain exams were set at a final score of 70 (p. 41).<sup>1</sup>
8. Also according to EBJ, the passing score was set based on the needs of the department, the score distribution, and adverse impact (see pp. 41-42).
9. There is no evidence demonstrating that those who pass are deemed qualified and that those who fail are deemed not qualified; those who fail simply score lower and are precluded from being considered if they fall below the pass score.
10. Assuming the exam is valid, candidates receiving lower scores on the exam might be considered less qualified based on exam results; however, this does not mean that they are not qualified.
11. Given that both exam procedures were promotional exams and that all candidates had several years of experience in the job at the rank below the job they were testing for, it is highly unlikely that candidates scoring below 70 could be considered not qualified.
12. Furthermore, if the candidate receiving a score of 70 is qualified, it is doubtful that the candidate receiving a score of 69.7 could be considered to be not qualified.
13. Given that 84 Lieutenant candidates passed the exam and 33 Captain candidates passed the exam, the pass score is essentially meaningless.

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<sup>1</sup> It should be noted that the passing score was not actually set at a final score of 70 as stated in the validity report. The passing score was actually set at a composite z-score (i.e., COMPZ in Appendix O of EBJ's validity report) = -0.90. Scores were then rescaled such that a composite z-score of -0.90 = 70 and the highest score = 100 (see OVERALL in Appendix O).

14. Setting a passing score far below what would be used in practice is hardly an appropriate method of avoiding adverse impact; the implication would be that test developers and employers could simply pass all candidates and conclude that adverse impact does not exist even if there is adverse impact on actual selection or promotion decisions.
15. The model for assessing adverse impact as reported in our report (Centrus, September 7, 2007), in my deposition (July 2, 2008), and reported by Dr. Jacobs (October 9, 2007) and Dr. Johnson (September 7, 2007) is the correct model. The model of examining adverse impact proposed by Dr. Jeanneret (i.e., estimating adverse impact via an assessment of pass rates and subsequently examining adverse impact via an assessment of promotion rates excluding candidates that failed) is an incorrect model.

### **The Use of Statistical Tests in the Context of Adverse Impact**

16. Statistical tests are used to make inferences about a population based on data that are obtained from a sample of that population. Statistical tests evaluate the relationship between two or more variables that are measured in a sample. In the context of adverse impact, statistical tests assess the relationship between group membership (e.g., members of a particular race) and decision outcome (e.g., promoted vs. not promoted). One does not know if adverse impact truly exists in some defined population. Therefore, we make the best decision we can based on the results obtained in a sample.
17. Statistical tests of adverse impact estimate the probability of obtaining the observed sample results assuming there is no relationship between group membership and outcome in the population. Statistical tests of adverse impact test the following hypothesis (or null hypothesis): there is no relationship between group membership and decision outcome (i.e., subgroups do not differ in decision outcome; there is no adverse impact); any observed difference is due to chance. Given this null hypothesis, there are four possible decision outcomes as shown in the following table:

		Truth (unknown)	
		No adverse impact exists	Adverse impact exists
Decision	No adverse impact exists	Correct acceptance	Type II error ( $\beta$ )
	Adverse impact exists	Type I error ( $\alpha$ )	Power (Correct rejection)

\* Correct acceptance: Correctly accepting the null hypothesis. The truth (which is unknown) is that the population does not have adverse impact and it is decided based on the results of the statistical test that there is no adverse impact.

\* Power: Correctly rejecting the null hypothesis. The truth (which is unknown) is that the population does have adverse impact and it is decided based on the results of the statistical test that there is adverse impact.

\*Type I error: Incorrectly accepting the null hypothesis. The truth (which is unknown) is that the population does not have adverse impact but it is incorrectly decided based on the results of the statistical test that there is adverse impact. This is sometimes referred to as alpha error (or  $\alpha$ ).

\* Type II error: Incorrectly rejecting the null hypothesis. The truth (which is unknown) is that the population does have adverse impact but it is incorrectly decided based on the results of the statistical test that there is no adverse impact. This is sometimes referred to as beta error (or  $\beta$ ).

18. A statistically significant result is one in which the probability of incorrectly concluding that adverse impact exists (i.e., a Type I error) is less than a specified level; this specified level is referred to as an alpha level (or  $\alpha$ ).
19. Statistical tests produce a probability value (or  $p$ -value) that determines or estimates the probability of obtaining the sample result assuming there were no differences in the population.
20. If the  $p$ -value resulting from the statistical test is less than the specified alpha level, we say the result is statistically significant and would decide, based on the test, that there is adverse impact. For example, if an alpha level of .05 is chosen and the  $p$ -value resulting from the statistical test is less than .05, then there is less than a 5% probability that the difference is due to chance (i.e., there is less than a 5% probability of making a Type I error) and we say the result is statistically significant.

#### **Comparison of the 4/5ths Rule and Statistical Tests**

21. The primary disadvantage of the 4/5ths rule is that it is more prone to making Type I errors than statistical tests are (Collins & Morris, 2008; Roth, Bobko & Switzer, 2006; see also Ironson, Guion & Ostrander, 1982; Lawshe, 1987; Morris, 2001; Morris & Lobsenz, 2000).
22. Therefore, an advantage of statistical tests, compared to the four-fifths rule, is that tests of statistical significance can control Type I error through the chosen alpha level (the four-fifths rule is not considered a statistical test as traditionally defined because it does not provide a  $p$ -value to compare to an alpha level). The probability of making a Type I error could be decreased by lowering the chosen alpha level or increased by raising the chosen alpha level.
23. The 4/5ths rule has some important *advantages* over statistical tests. First, the impact ratio describes the magnitude of the selection rate difference between the groups that are being compared whereas statistical tests simply indicate whether or not there is less than a 5% probability that the results are due to chance (or whether or not there is less than a 5% chance of making a Type I error).
24. Therefore, a disadvantage of statistical tests is that they do not describe how meaningful the differences are; trivial differences can be significant when the sample size is large, and meaningful differences can be non-significant when the sample size is small (see Question and Answer #20 of the Uniform Guidelines).

25. The second advantage of the 4/5ths rule is that it is more powerful and less likely to make a Type II error than statistical tests are, especially when samples sizes are relatively small and less balanced (Collins & Morris, 2008; Morris, 2001).<sup>2</sup>
26. Low power is problematic because, if a statistical test is not significant, it cannot be certain if adverse impact truly does not exist or if the result is due to chance, or a Type II error.
27. The core difference between the impact ratio and statistical tests is a trade-off between the probability of making a Type I error vs. the probability of making a Type II error.
28. Although the exact probability of Type I error for the 4/5ths rule cannot be determined, it can be estimated to be in the range of .17 (see Roth, Bobko & Switzer, 2006, Table 1) to .31 (see Collins & Morris, 2008, Table 2) for the Fire Lieutenant promotional process.<sup>3</sup>
29. The probability of a Type II error using statistical tests is around .8 for the Fire Lieutenant promotional process (Dr. Johnson, June 23, 2008).
30. Therefore, in the case of Fire Lieutenant, conclusions based on statistical tests are far more likely to be erroneous than conclusions based on the 4/5ths rule.<sup>4</sup>
31. Hays (1994) states that:

Although it is true that the conventional rules usually involve  $\alpha$  values such as .05 and .01, the choice of  $\alpha$  is not always totally arbitrary. The choice of  $\alpha$  also is influenced by a balance that the experimenter strikes between the two kinds of errors possible in drawing conclusions from a test of hypotheses (p. 283)

...

However, in some social or behavioral science research, it is hard to see exactly why the particular hypothesis tested, [or null hypotheses], should be the one we are loath to abandon and why Type I errors necessarily have this drastic character. Granting that scientific discretion is commendable, the mistaken conclusion that "something really happened" is not necessarily worse than overlooking a real experimental phenomenon. In some situations, perhaps, we should be far more attentive to Type II errors and less attentive to setting  $\alpha$  at one of the conventional levels. Furthermore, if the conventional  $\alpha$  levels are to be used, a little more thought might be given to deciding exactly what is the null hypothesis we want to be so careful not to reject falsely (p. 284).
32. Null hypothesis testing is a highly debated topic in the behavioral sciences and has been for several decades. In fact, the American Psychological Association developed a Task Force on Statistical Inference (<http://www.apa.org/science/bsaweb-tfsi.html>) to examine this issue and develop appropriate guidelines. The APA and many journal editors now caution against relying solely on Type I error rates (or the decision of accepting or rejecting a hypothesis based only on probability and alpha values) for making decisions or drawing inferences based on statistical tests.
33. Dr. Jeanneret (October 8, 2007) states that the 4/5ths rule (or the .80 value) is arbitrary and implies that this is somehow a limitation. However, it is no more arbitrary than the .05 alpha level typically chosen in statistical tests.

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<sup>2</sup> A balanced sample would be one that has 50% minority and 50% majority as well as 50% not promoted and 50% promoted.

<sup>3</sup> Table 2 in Collins and Morris (2008) reports a Type I error rate of .358 for 10% minority and .270 for 30% minority. The Fire Lieutenant candidate pool was comprised of 20% minority. Therefore, .358 and .270 were averaged to estimate the probability of Type I error for Lieutenant.

<sup>4</sup> The probability of making a Type I error using statistical tests is zero since the decision that is made based on the test would be that adverse impact does not exist. Similarly, the probability of making a Type II error using the 4/5ths rule is zero since the decision that is made based on the test would be that adverse impact does exist.

34. Assuming a .05 alpha level, a statistical test that results in a  $p$ -value of .04999 is significant yet a  $p$ -value of .05001 is not; the difference between these two probabilities can hardly be considered meaningful, yet the arbitrarily chosen alpha level of .05 results in the conclusion that one is statistically significant and the other is not.

### Statistical Tests for Assessing Adverse Impact

35. Collins and Morris (2008, pp. 465-466) describe three possible sampling models on which statistical tests for 2 X 2 contingency tables are based.<sup>5</sup> They indicate that none of the sampling models adequately describe the type of decision used in top-down selection. They also state that:

when evaluating a promotion decision, the pool of candidates is relatively fixed. If the decision were repeated at a different point in time, the set of candidates under consideration would be mostly the same. In such cases, probabilities based on randomly sampling from a population...would not apply. Similarly, probabilities based on random reassignment of participants...would not be appropriate. Without some theoretical process for producing different patterns of data (e.g., random sampling or random assignment), statistical significance cannot be defined (p. 466).

36. This would suggest that using statistical tests (including the Fisher exact and chi-square tests) would not be an appropriate method for determining adverse impact on the Lieutenant and Captain promotional procedures.
37. Using statistical tests for promotional exams is almost analogous to using a statistical test to determine if the number of green M&Ms is greater than the number of red M&Ms in a 1 pound bag of M&Ms.<sup>6</sup> I do not need a statistical test to determine this – I can simply count them. If I wanted to determine if the number of green M&Ms is greater than the number of red M&Ms in the entire population of M&Ms currently available in the world, I could use a statistical test and analyze the sample of M&Ms in my 1 pound bag.
38. Even though statistical tests are not necessarily appropriate for making decisions regarding the adverse impact associated with the Fire Lieutenant and Captain promotional procedures, I present statistical tests that are used for assessing adverse impact and the results of these analyses below.
39. Chi-square is a statistical test that is frequently used to assess adverse impact and the pooled two-sample z-score test (or  $Z_D$ ) is the statistical test recommended by the Office of Federal Contract Compliance Programs (OFCCP; 1993).
40. When analyzing a 2 X 2 contingency table (see footnote 5), the pooled two-sample z-score test is mathematically equivalent to the chi-square test (Moore & McCabe, 1993).
41. The z-test of the ratio of selection rates (or  $Z_{IR}$ ), is a more recently developed statistical test for assessing adverse impact. Morris and Lobsenz (2000) indicate that the  $Z_{IR}$  test has a few advantages over the  $Z_D$  test (and over the chi-square test since the  $Z_D$  and chi-square tests are mathematically equivalent when analyzing 2 X 2 contingency tables).

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<sup>5</sup> A 2 X 2 contingency table is an analysis of two qualitative variables, each of which has two levels. For example, the two variables may be race (with two levels: Black vs. White) and outcome (with two levels: promoted vs. not promoted). Analyses of adverse impact for Fire Lieutenant and Captain analyze 2 X 2 contingency tables.

<sup>6</sup> It is almost the same type of situation. In promotional exams, the sample is *mostly* the same. In this example, the sample is *exactly* the same. However, statistical significance cannot be defined in either situation.

42. One advantage is that the  $Z_{IR}$  test uses the same comparison as the four-fifths rule (i.e., a selection rate *ratio*) whereas  $Z_D$  compares the *difference* in selection rates. Given that the four-fifths rule (or impact ratio) compares the ratio of selection rates and the  $Z_D$  compares the difference in selection rates, comparing the results is somewhat like comparing apples and oranges. In contrast, comparing the  $Z_{IR}$  test to the impact ratio is a more equivalent comparison.
43. A second advantage of the  $Z_{IR}$  test is that it is slightly more powerful than the  $Z_D$  or chi-square tests, especially as the proportion of minorities is smaller.
44. The OFCCP (1993) recommends using the Fisher exact test when sample sizes are small (i.e., the total number of applicants or candidates is less than 30 and the minimum expected frequency is less than 5).<sup>7</sup>
45. The Fisher exact test calculates the exact probability of obtaining the sample result whereas the chi-square test *estimates* the exact probability of the obtained sample results.
46. Moore and McCabe (1993) state that when analyzing data in a 2 X 2 contingency table, if the minimum expected frequency is less than 5, estimated statistical techniques such as chi-square should not be used; furthermore, Hays (1994) cautions that a minimum expected frequency of 10 is much safer.
47. These (Moore & McCabe; Hays) are two well regarded statistical text books; however, neither text is peer reviewed. In addition, authors of neither text cite any research or evidence to support their cautions regarding minimum expected frequencies.
48. Dr. Jeanneret references Seigel (1956) to suggest that power is not an issue with the Fisher's test. Seigel is another text book and is not peer reviewed.
49. Contrary to the admonitions of Hays (1994), Moore and McCabe (1993), Seigel (1956), and Dr. Jeanneret; Collins and Morris (2008; this is a peer reviewed article in the Journal of Applied Psychology, the most highly regarded journal in the field of Industrial/Organizational Psychology) have shown that the chi-square test holds up well under conditions of small samples (e.g., less than 100 total applicants and a minimum expected frequency of less than 5).
50. The peer-reviewed study of Collins and Morris (2008) also demonstrate that the Fisher exact test is overly conservative under these conditions (i.e., it essentially eliminates the possibility of Type I error but does so at the expense of low power and a high probability of Type II error). They state that:

The Z-test [or chi-square] provided a good balance of maintaining the nominal error rate and maximizing power. In contrast, the Fisher Exact test...[was] overly conservative except for extremely large  $N$ s [or sample sizes] and consequently had lower power under many conditions. Given its lower power to detect true cases of adverse impact, *recommendations to use the Fisher Exact Test for adverse impact assessment (OFCCP, 1993, Siskin & Trippi, 2005) should be reconsidered* [italics added] (p. 470).<sup>8</sup>
51. The Collins and Morris study analyzed simulated (or computer generated) data that represented sample properties or characteristics typical of adverse impact analyses; the

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<sup>7</sup> The minimum expected frequency is the smallest of the four expected frequencies in a 2 X 2 contingency table.

<sup>8</sup> Collins and Morris (2008) is peer reviewed. Neither the OFCCP nor Siskin & Trippi are peer reviewed. Dr. Jeanneret (October 8, 2007) based some of his expert opinions on Siskin & Trippi (e.g., p. 11, 24).

results and implications cannot be dismissed as “just one study” or as a sample specific result that does not generalize.

52. Peer reviewed research published in the Journal of Applied Psychology demonstrates that the Fisher’s exact test has low power; lower than the chi-square test and the 4/5ths rule (Collins & Morris, 2008). Therefore, Dr. Jeanneret’s statement suggesting that power is not an issue with the Fisher exact test should now be viewed as incorrect.<sup>9</sup>
53. Dr. Jacobs (October 9, 2007) argues that the 4/5ths rule is unstable with small numbers. What he fails to mention is that statistical tests are also unstable with small numbers.
54. If one *more* Black candidate was promoted for Lieutenant, the *p*-value for Fisher’s exact “jumps” from .26 to .58; if one *less* Black candidate was promoted it “jumps” down to .054 (.05 would be considered statistically significant at a .05 alpha level). The chi-square and  $Z_{IR}$  tests are both statistically significant when one less Black candidate is promoted.
55. Dr. Jacobs then attempts to demonstrate the instability of the impact ratio by picking a few ranks that would not have resulted in a 4/5ths rule violation. However, 28 of the top 39 ranks (72%) would have resulted in a 4/5ths rule violation.
56. The Uniform Guidelines clearly indicate that the 4/5ths rule is the preferred method for determining adverse impact (see Questions and Answers #18, 23, and 24) unless samples are (very) small (see Questions and Answers #20 and 21) or very large (see Questions and Answers #20 and 22).
57. Question and Answer #20 suggests that the 4/5ths rule should not be used when samples are *very* small. The example provided in Question and Answer #20 has 4 applicants that are selected from a total applicant pool of 30. Even the Captain promotional procedure cannot be considered this small since it was comprised of at least 33% more total applicants and 300% more hires/promotions.
58. Question and Answer #21 outlines an alternative method (sometimes referred to as the *N of 1 rule* or *flip-flop rule*) for determining if a 4/5ths rule violation is due to fluctuations resulting from a small sample.
59. Instead of following the method outlined in Question and Answer #21, Dr. Jeanneret (October 8, 2007) only quoted part of the answer to Question #21 (see p. 21; he ignored the N of 1 rule) and Dr. Jacobs and Dr. Jeanneret devised their own rule or methodology to reach their conclusion that the finding of adverse impact is due to small samples.<sup>10</sup>
60. Furthermore, Dr. Jeanneret (October 8, 2007) found it interesting that many of the numbers from the example provided in Question and Answer #21 are similar to the numbers for Fire Captain. However, the most important number is the impact ratio; the impact ratio from the example provided in Question and Answer #21 (= .75) is hardly similar to the impact ratio for the Fire Captain exam in the City of Akron (= .39).

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<sup>9</sup> It should be noted that Collins and Morris (2008) was published after the reports addressing adverse impact were submitted by the experts for both the plaintiffs and defendant.

<sup>10</sup> Dr. Jeanneret also only quotes the first portion of Question and Answer #23 (see p. 21). The rest of the answer states “See Section 4D and Questions 20 and 21”, which, as explained previously, describe *very* small samples (much smaller than Captain) and the N of 1 rule, respectively.

61. It is important to note that the Uniform Guidelines do not indicate that statistical tests should be used in lieu of the impact ratio when samples sizes are small. In contrast, Questions #20 and 22 indicate that statistical tests should be used with *large* samples to determine if adverse impact is statistically significant *even when the impact ratio is greater than .80*.

**Adverse Impact Results: 4/5ths Rule**

62. *Lieutenant – Race*: There is a 4/5ths rule violation for race (impact ratio = .49) for the Lieutenant promotional procedure (see our [CentrusPS] September 7, 2007 report). ***There is adverse impact against Black candidates.***
63. *Lieutenant – Age*: There is a 4/5ths rule violation for age (impact ratio = .61) for the Lieutenant promotional procedure (see our [CentrusPS] September 7, 2007 report). ***There is adverse impact against candidates ages 40 and older.***
64. Dr. Jacobs (October 9, 2007) suggests that because age is a continuous variable that this can be overlooked or that it is appropriate to look at “other ages such as 38 or 39” (p. 3). However, this is not correct. The Age Discrimination in Employment Act creates two categories of ages: (1) those under 40 and (2) those 40 and older. Those ages 40 and older are protected under the act.
65. One could also argue, *inappropriately*, that ethnicity or color could be considered continuous variables. However, the continuous variable argument and consideration of age categories different from those established in Federal law are irrelevant.
66. Dr. Jacobs also argues that adverse impact could be explained by the fact that candidates over 40 were more likely to skip orientation; however, he offers no evidence indicating that orientation is related to test scores. An equally plausible explanation for orientation attendance might be that older candidates have already been to orientation for prior exams and have more experience taking exams and may find no further value in attending orientation again.
67. Finally, Dr. Jacobs states that race and age are not independent (i.e., there is a relationship between race and age such that older candidates are more likely to be Black) and that older candidates probably took the test prior to this point and have not been promoted; he does not support this statement with test score data. Furthermore, were this true, it would suggest that the City of Akron has a history or pattern of not promoting older candidates and Black candidates.
68. In the end, however, there is a 4/5ths rule violation for both race and age at the Lieutenant rank; suggested explanations for why it exists are irrelevant to the analysis. The finding of adverse impact requires evidence demonstrating the validity of the examination, not speculation for why it has occurred.
69. *Captain Race*. There is a 4/5ths rule violation for race (impact ratio = .39) for the Captain promotional procedure (see our [CentrusPS] September 7, 2007 report). ***There is adverse impact against White candidates.***
70. *Captain Age*. There is no 4/5ths rule violation for age (impact ratio = .86) for the Captain promotional procedure (see our [CentrusPS] September 7, 2007 report). No further statistical analyses were performed and no further statistical analyses are subsequently discussed regarding adverse impact for age on the Captain promotional procedure.

**Adverse Impact Results: Uniform Guidelines Question & Answer #21 (The N of 1 Rule)**

71. Uniform Guidelines Question & Answer #21 describe a methodology to follow to determine if a 4/5ths rule violation may be a result of a small sample:

If only one more black had been hired instead of a white the selection rate for blacks (20%) would be higher than that for whites (18.7%). Generally, it is inappropriate to require validity evidence or to take enforcement action where the number of persons and the difference in selection rates are so small that the *selection of one different person* [italics added] for one job would shift the result from adverse impact against one group to a situation in which that group *has a higher selection rate* [italics added] than the other group.

72. As indicated above, if the selection of one different person results in the group with the lowest selection rate now having the highest selection rate, then violations of the 4/5ths rule are likely due to a small sample size.
73. Neither Dr. Jacobs nor Dr. Jeanneret used the methodology outlined by the Uniform Guidelines. Rather, both Dr. Jacobs and Dr. Jeanneret changed multiple individuals (instead of one) and stopped when the impact ratio exceeded .80 (instead of when the selection rates flip-flopped).
74. Neither of them offers a source for this methodology; it certainly is not specified in the Uniform Guidelines and it is a much more liberal methodology than that described in the Uniform Guidelines.
75. The results from the correct application of Question & Answer #21 (or the N of 1 rule) are presented below (these results were also presented as Defendant's Exhibits 188 and 189 during my July 2, 2008 deposition).
- *Lieutenant Race*. If one more person is changed the impact ratio is .68 and the selection rate for Blacks (20.0%) is still smaller than the selection rate for Whites (29.6%). In fact, three more Blacks (i.e., twice as many Blacks) would have to be promoted for Blacks to have a higher selection rate than Whites.
  - *Lieutenant Age*. If one more person is changed the impact ratio is .72 and the selection rate for candidates 40 and older (22.5%) is still smaller than the selection rate for candidates under 40 (31.1%). In fact, four more candidates 40 and older (i.e., 50% more) would have to be promoted for candidates 40 and older to have a higher selection rate than candidates under 40.
  - *Captain Race*. If one more person is changed the impact ratio is still only .56 and the selection rate for Whites (25.0%) is still smaller than the selection rate for Blacks (44.4%). In fact, three more Whites would have to be promoted for Whites to have a higher selection rate than Blacks.
76. Given that Drs. Jacobs and Jeanneret offered results of a far more liberal methodology, I followed a slightly more conservative methodology and determined what would happen if one more person was changed in the other direction (i.e., selecting one more from the group with the highest selection rate rather than the group with lowest selection rate; these results were also discussed and presented in my deposition in Exhibits 188 and 189). For the Lieutenant promotional procedure, changing one more person results in statistically significant differences for the chi-square,  $Z_D$ , and  $Z_{IR}$  tests (the  $p$ -value for Fisher's exact was = .054) for race and the  $Z_{IR}$  test was significant for age (the  $p$ -value for Fisher's exact was =

.07 and for chi-square was = .06). For the Captain promotional procedure, the Fisher exact, chi-square,  $Z_D$  and  $Z_{IR}$  tests were all significant for race.

#### **Adverse Impact Results: Statistical Tests**

77. *Lieutenant Race*. Fisher exact, chi-square (and  $Z_D$ ), and  $Z_{IR}$  are all non-significant. As stated previously, under these sample conditions, statistical tests have low power and a high Type II error rate. There is approximately an 80% probability that the results of these tests are inaccurate (i.e., the Type II error rate is approximately .8).
78. *Lieutenant Age*. Fisher exact, chi-square (and  $Z_D$ ), and  $Z_{IR}$  are all non-significant. As stated previously, under these conditions, statistical tests have low power and a high Type II error rate.
79. *Captain Race*. Fisher exact and the  $Z_{IR}$  are not statistically significant. Chi-square (and  $Z_D$ ) is statistically significant. There is less than a 5% probability that the chi-square result is due to chance (or less than a 5% probability of making a Type I error). There is adverse impact against White candidates. The probability of a Type II error is zero because the decision that was made based on the statistical test is that adverse impact exists.
80. Collins and Morris (2008) demonstrate that chi-square is the most appropriate statistical test under sample conditions such as those of the Fire Captain promotional procedure. The chi-square test was not reported in our (CentrusPS) September 7, 2007 report because we, like most other Industrial/Organizational Psychologists, followed the recommendation of statistical textbooks to not use chi-square when the minimum expected frequency is less than 5. The findings from Collins and Morris (2008) were published after our expert reports were submitted.

#### **Adverse Impact Conclusions**

81. When considering all of the evidence and weighing both the strengths and weaknesses of statistical tests and the 4/5ths rule and appropriately applying the N of 1 rule as specified in Question and Answer #21 of the Uniform Guidelines, the following conclusions are reached:
  - There is adverse impact against Black candidates on the Lieutenant promotional procedure.
  - There is adverse impact against candidates ages 40 and older on the Lieutenant promotional procedure.
  - There is adverse impact against White candidates on the Captain promotional procedure.
  - There is not adverse impact against candidates ages 40 and older on the Captain promotional procedure.
  - The use of the Lieutenant and Captain promotional procedures should be considered to be discriminatory and inconsistent with the Uniform Guidelines, unless the procedure has been validated in accordance with the Uniform Guidelines (see Uniform Guidelines, Section 3A).

#### **Validity Evidence: Job Analysis**

82. Two primary resources serve as the basis for determining the requirements for establishing the validity of a selection procedure: the Uniform Guidelines and the SIOP Principles. Because no statistical relationship has been established between the scores on the selection procedures for Fire Lieutenant and Fire Captain and some relevant performance criteria, the

Uniform Guidelines and SIOP Principles require that the selection procedure be validated using a “content validity” or “validity based on content” approach.

83. In order to be considered content valid, it is vital that the selection procedure is representative of the job. According to the SIOP Principles, “(e)vidence for validity based on content rests on demonstrating that the selection procedure adequately samples and is linked to the important work behaviors, activities, and/or worker KSAOs (knowledge, skills, abilities, and other characteristics) defined by the analysis of work” (p. 25). Furthermore, the Uniform Guidelines (Section 14C (4)) indicate that a job analysis is required for content validity studies and

To demonstrate the content validity of a selection procedure, a user should show that the behavior(s) demonstrated in the selection procedure are a representative sample of the behavior(s) of the job in question or that the selection procedure provides a representative sample of the work product of the job.

...

In addition, to be content valid, a selection procedure measuring a skill or ability should either closely approximate an observable work behavior, or its product should closely approximate an observable work product. If a test purports to sample a work behavior or to provide a sample of a work product, the manner and setting of the selection procedure and its level and complexity should closely approximate the work situation. The closer the content and the context of the selection procedure are to work samples or work behaviors, the stronger is the basis for showing content validity. As the content of the selection procedure less resembles a work behavior, or the setting and manner of the administration of the selection procedure less resemble the work situation, or the result less resembles a work product, the less likely the selection procedure is to be content valid, and the greater the need for other evidence of validity.

84. EBJ utilized a “streamlined” job analysis at the City of Akron rather than the “traditional” job analysis that they use at other municipalities (see also Dr. Jacobs, October 9, 2007).
85. According to the SIOP Principles, “studying multiple incumbents may be necessary to understand differences in work complexity, work context, work environment, job behaviors, or worker KSAOs as a function of shift, location, variations in how work is performed, and other factors that may create differences in similar job titles or worker families.” (p. 12). The number of subject matter experts (SMEs) used in the streamlined job analyses at the City of Akron was insufficient. Only six SMEs were used in each of the job analyses. No Captains were used in the Lieutenant job analysis (only one higher-ranking SME was used – a District Chief). Only two incumbents were used in the Captain job analysis. This is especially problematic when job analysis results are based on SME ratings on survey items (e.g., task ratings). Survey ratings such as these are highly prone to error when samples are this small and result in a very low confidence levels (see pp. 8-10 and Tables 8 and 9 of our [CentrusPS] September 7, 2007 report).
86. When developing the task list for the City of Akron, “primary emphasis was placed on comprehensive tasks lists that had been derived by EBJ through previous work conducted with a number of other municipal agencies.” (EBJ, p. 10). According to the SIOP Principles, “(t)he success of the content-based validation study is closely related to the qualifications of the subject matter experts (SMEs). *SMEs* [italics added] define the work domain and participate in the analysis of work by identifying the important work behaviors, activities, and worker KSAOs.” (p. 22). The input (or lack thereof) provided by SMEs was insufficient for demonstrating that the job analysis derived from other municipalities is applicable to the City of Akron.

87. The Uniform Guidelines (Section 14 C), SIOP Principles (p. 23) and APA Standards (p. 160; 14.8) indicate that the exam content should be based on important work behaviors, knowledge, skills, and abilities that the employee is expected to have before selection/promotion into the job. EBJ demonstrated which knowledge sources were “used on day one” but failed to demonstrate which duties, tasks, and abilities are used on day one.
88. Only 12 abilities were presented to SMEs and EBJ offers no evidence that SMEs were allowed to provide input regarding additional abilities. The Occupational Information Network (O\*NET; <http://online.onetcenter.org>) lists 20 skills and abilities for the jobs of Municipal Fire Fighters and Municipal Fire Fighting and Prevention Superiors and other resources are available for identifying many more potential abilities (e.g., SMEs, Fleishman Job Analysis Survey). Considering only 12 abilities is insufficient. Furthermore, it is impossible to conclude that a representative sample of abilities was assessed in the exam procedures if the entire domain of abilities is not defined.
89. The foundation upon which a content valid test is built is a job analysis; without a thorough analysis of the job, one cannot know if the test resembles the job and, therefore, cannot demonstrate that the test is valid. The job analyses for both Lieutenant and Captain were inadequate in terms of procedure and content. Regardless of the type or quality of the examinations that were used, the examinations cannot be demonstrated to be job related or valid.

#### **Validity Evidence: Exam Content and Procedures**

90. EBJ established exam component weights before the exam components were developed (see also Dr. Jeanneret, October 8, 2007, p. 38). It is not possible to determine the importance of a component that does not yet exist.
91. EBJ described two weighting strategies that were based directly on SME judgments derived from the job analysis. They chose to use a third weighting method that was not based directly on SME judgment. The “Sum of Weighted Means” method that was based directly on SME judgments would have resulted in less adverse impact for race on the Lieutenant exam and no adverse impact for race on the Captain exam.
92. There was no consideration of alternative measures as prescribed by the Uniform Guidelines and the SIOP Principles. It appears that EBJ came into the project with an “off-the-shelf” testing methodology and then considered which of the knowledge sources and scant abilities might best be assessed by this methodology. For both the written work sample and the oral board test, “the goal was to assess the abilities found to be important and also *amenable to testing using the proposed testing modality* [italics added]” (EBJ, pp. 17-18). Rather than identifying which KSAs can be assessed by a pre-defined testing modality, an appropriate method for developing a test plan would be to identify the most important work behaviors and KSAs and then consider professionally acceptable methods of measuring these given work behaviors and/or KSAs.
93. Written test items for both the Lieutenant and Captain exams were not linked to work behaviors as required by the Uniform Guidelines (see Question & Answer #79).
94. Approximately one-third of the items on the written test for both Lieutenant (32% of items) and Captain (34% of items) were rated as “needing to be committed to memory half of the time and can be referenced half of the time”. Because the knowledge test was a closed book

examination, the candidates were not able to reference the tested knowledge source needed to correctly answer each of the questions, despite the ratings indicating that some parts of the knowledge domain could be referenced half (50%) of the time.

95. The knowledge that was assessed in the exam procedure was not representative of the entire knowledge domain. Approximately 40% of the knowledge areas that were rated as Critical (i.e., an importance value of 3 in Appendix H of the EBJ validity report) were not assessed in the promotional procedure. None of the knowledge that could be “referenced all (100%) of the time” was measured.
96. Although EBJ indicates that assessor ratings were independent, the fact that the assessors made their ratings sitting next to each other in the same room and evidence from the rating forms showing that several assessor ratings were changed suggest that the ratings were not independent.
97. Independent ratings are required for properly estimating inter-rater reliability. If ratings were not independent, reliability cannot be estimated. The actual reliability would be lower (perhaps substantially lower) than that reported by EBJ.
98. As indicated by EBJ, significant differences were observed as a function of panel assignment on all exercises that utilized panel ratings. If ratings were independent, it was inappropriate to standardize scores within panels to correct panel differences. Assessor ratings should have been regarded as reliable independent ratings, not as panel error.
99. Differences due to panel assignment could have been easily prevented by rotating assessors among panels throughout the assessment procedure.
100. The behaviorally anchored ratings scales that were used to score the exercise dimensions were not sufficiently specific to the exercises. The behavioral anchors for four of the dimensions (information analysis, judgment and decision making, planning and organizing, and resource management) were identical across the Lieutenant written work sample and oral board tests despite the fact that the scenarios and the method of responses were completely different. In addition, the behavioral anchors for the Lieutenant oral board were the same as those used for the Captain oral board. In order to effectively serve as objective criteria by which assessors can validly evaluate the responses of the candidates, the anchors must be developed to be clearly related to the exercises for which they are used and should be reflective of the job.
101. The nature of the written work sample exercise did not provide sufficient linkage to each of the abilities that were purportedly assessed. Particularly, interpersonal skills and resource management are insufficiently assessed by the exercise. This is evidenced by the lack of behavioral anchors relevant to the exercise and inclusion of behavioral anchors that are irrelevant to the exercise on the rating scales for the aforementioned ability areas. Reviewing the “Possible Candidate Responses” generated by EBJ and included in the Written Work Sample Assessor Training Manual (see EBJ Confidential Appendix 3, p. 52) further highlights the lack of adequate linkage between the written work sample and the abilities it is claimed to assess, as no “possible candidate responses” listed by EBJ related to the interpersonal relations dimension as defined within the same assessor manual (see p. 22).
102. Inter-rater reliability for the written work sample was insufficient. A likely reason for the low reliability is the use of vague, global behavioral anchors. More specific anchors can

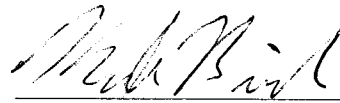
reduce the subjective judgment required by the assessors, reduce error, and increase reliability.

103. Candidates were ranked based on the final composite score. According to the Uniform Guidelines, “(i)f a user can show, by a job analysis or otherwise, that a higher score on a content valid selection procedure is likely to result in better job performance, the results may be used to rank persons who score above minimum levels. Where a selection procedure supported solely or primarily by content validity is used to rank job candidates, the selection procedure should measure those aspects of performance which *differentiate* [italics added] among levels of job performance” (Section 14 C (9)). Despite the fact that the Akron Fire Department promotes based on rank in a top-down fashion using the “rule of three”, EBJ’s validation study gathered no evidence that demonstrates that the KSAs utilized as the basis for the selection process are able to distinguish (beyond some minimally acceptable level) superior from acceptable candidates. The failure to collect data regarding this distinguishing value makes it improper to conclude that the selection procedure was appropriate to rank candidates based on the aspects of performance that were measured.

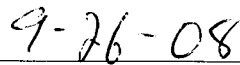
104. Listed below is the professional literature that was referenced in this declaration:

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**EDUCATION**

**Doctorate of Philosophy** – The University of Georgia, Athens, GA August 2003  
Major: Industrial/Organizational Psychology  
Dissertation Title: *New Hire Socialization: The Dynamic Relationships Among Individual Differences, Cognition, Affect, and Behavior*

**Master of Science** – The University of Georgia, Athens, GA August 2000  
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Thesis Title: *Self-monitoring and Goal Orientation: Moderators in the Variable Effects of Feedback on Self-efficacy and Self-set Goals*

**Bachelor of Science** – Grand Valley State University, Allendale, MI April 1998  
Major: Psychology Minor: Business

**RESEARCH & PRESENTATIONS**

- Birkelbach, D., **Brink, K. E.**, & Lance, C. E. (September, 2008). Race bias in structured interview and assessment center ratings. In **K. E. Brink** & J. L. Crenshaw (Chairs), *Unraveling Ethnic Differences in Structured Interviews*. Symposium under review for the meeting of the Society for Industrial and Organizational Psychology, San Francisco, CA.
- Brink, K. E.**, & Crenshaw, J. L. (September, 2008). Comparing Black-White differences on video vs. audio structured situational interviews. In **K. E. Brink** & J. L. Crenshaw (Chairs), *Unraveling Ethnic Differences in Structured Interviews*. Symposium under review for the meeting of the Society for Industrial and Organizational Psychology, San Francisco, CA.
- Brink, K. E.** (July, 2008). Adverse Impact. Under review in W. J. Rothwell (Ed.) *Human Resource Encyclopedia Volume 1 - Articles*. San Francisco, CA: Pfeiffer.
- Brink, K. E.** (July, 2008). Adverse Impact Analysis. Under review in W. J. Rothwell (Ed.) *Human Resource Encyclopedia Volume 2 – Forms and Tools*. San Francisco, CA: Pfeiffer.
- Brink, K. E.** & Crenshaw, J. L. (2008). *Adverse impact: What is it and how do you calculate it?* Tutorial presented at the meeting of the International Public Management Association Assessment Council, Oakland, CA.
- Brink, K. E.**, Crenshaw, J. L., & Alber, M. (2008). Relationships between completion time, performance and faking on biodata/personality measures. In **K. E. Brink** (Chair), *The Fourth Dimension: How Response Times Impact Test Performance*. Symposium conducted at the meeting of the Society for Industrial and Organizational Psychology, San Francisco, CA.
- Brink, K. E.** & Lance, C. E. (2008). Development and validation of a newcomer socialization measure of information seeking frequency. In K. Zhang (Chair), *Feedback Seeking: New*

*Developments*. Paper session presented at the meeting of the Academy of Management, Anaheim, CA.

- Brink, K. E.,** Lance, C. E., Bellenger, B. L., Morrison, M. A., Scharlau, E. A., Crenshaw, J. L. (2008). Discriminant validity of a “next generation” assessment center. In B. J. Hoffman (Chair), *Reexamining Assessment Centers: Alternate Approaches*. Symposium conducted at the meeting of the Society for Industrial and Organizational Psychology, San Francisco, CA.
- Crenshaw, J. L., Bellenger, B. L., & **Brink, K. E.** (2008). *Video based testing: Advantages, limitations, and practical feasibility?* Paper presented at the meeting of the International Public Management Association Assessment Council, Oakland, CA.
- Bellenger, B. L., **Brink, K. E.,** & Crenshaw, J. L., (2007). *Public safety testing: Technology and innovation*. Presented at the Executive Council meeting of the International Association of Black Professional Fire Fighters, Birmingham, AL.
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- Brink, K. E.** & Thomas, K. M. (2001). *Self-monitoring and goal orientation: Moderators in the variable effects of feedback on self-efficacy and self-set goals*. Paper presented at the meeting of the Society for Industrial and Organizational Psychology, San Diego, CA.

#### **TEACHING EXPERIENCE (THE UNIVERSITY OF GEORGIA, PSYCHOLOGY DEPARTMENT)**

Psychology of the Workplace (PSYC 4230) Lab Instructor, Fall 2001

Psychology of Testing (PSYC 4210) – Course Instructor; Summer 2001; Lab Instructor; Fall 1999, Spring 2000, Summer 2001, Spring 2002

Research Analysis (PSYC 2990) – Lab Instructor; Summer 2000, Spring 2002

Research Design (PSYC 2980) – Course Instructor; Fall 2000, Spring 2001 (two sections)

Elementary Psychology (PSYC 1101) – Graduate Assistant; Fall 1999

#### **WORK EXPERIENCE**

**Centrus Personnel Solutions, LLC**, Birmingham, AL

05/07-Present *Principal Consultant*. Partner and principal consultant of human resources management consulting firm. Prepare proposals for obtaining contracts. Lead and manage consulting projects in the areas of job analysis, competency modeling, employee selection, test development and validation, litigation support, data analysis, organizational surveys,

performance management and appraisal, needs assessment and training program development, organizational development and structuring.

**Personnel Board of Jefferson County, Birmingham, AL**

05/03-Present *Industrial/Organizational Psychologist*. Manage a team of I/O professionals responsible for conducting validation studies. Have supervised over 200 job analyses. Developed cutting edge technology-based assessments that maximize validity and minimize adverse impact. Oversee writing of validity reports. Ensure all phases of job analysis, assessment development and administration comply with the Uniform Guidelines, SIOP Principles, APA Standards and all other applicable professional standards and laws. Responsible for the release of 12 positions from a long-standing Federal Consent Decree. Manage performance and development of subordinates. Assist in training and development of division staff members and establishing and improving procedures, policies, and practices. Initiated and executed several performance improvement initiatives. Instrumental in transforming the organization into a state-of-the-art government HR agency. Manage projects outsourced to external vendors.

**UPS, Atlanta, GA**

10/01-05/03 *Learning and Development Contractor*. Supported executives with processes and decisions related to career development, promotion, succession planning and diversity initiatives through data collection and analysis, presentations and recommendations. Produced monthly succession planning reports and recommendations for business function SVPs. Developed guidelines for candidate review meetings and action logs for candidate development. Handled highly confidential information daily. Developed more efficient and automated processes.

11/98-01/99 Analyzed and presented Employee Relations Index survey results to UPS executives.

**Cahners-TRACOM Group, Highlands Ranch, CO**

2001 *Consultant*. Generated and screened items for social style assessment tools. Dimensions included tell assertive, ask assertive, responsiveness-controls, responsiveness-emotes, image, competence, optimism, communication, empathy, conscientiousness, interpersonal relationships, innovation, flexibility and overall endorsement.

**BellSouth, Atlanta, GA**

7/00-11/00 *Performance Consulting Intern*. Supported the development of competency models for several job families. Assisted with focus groups. Developed, edited and standardized competency models.

**Southern Company, Atlanta, GA**

12/98-2/00 *Consultant*. Proctored paper and pencil assessments, acted in role-play exercises, scored in-basket, role-play and writing exercise assessments for first-line supervisor assessment center.

8/99-11/99 *Consultant*. Conducted employee exit interviews.

**College of Education, The University of Georgia, Athens, GA**

1999 *Consultant*. Led focus groups for the College of Education Multi-cultural Initiative.

**Irwin & Browning, Atlanta, GA**

1999 *Consultant*. Assisted with job analysis for the Photonic Technologies Division of Corning.

**BICC General**, Watkinsville, GA (manufacturing company producing wire and cable)

5/99-8/99 *Human Resources Intern*. Delivered Blood Borne Pathogens and Hazard Communication training to all employees. Initiated and developed assessment tool to evaluate the effectiveness of the training.

**J.W. Fanning Institute for Leadership, The University of Georgia**, Athens, GA

1998 Entered and analyzed data from USDA survey results.

**LITIGATION EXPERIENCE**

*W. Howe, et al. v. City of Akron*; Case Number 2006-04-2310, Akron, OH. Race and age discrimination in hiring practices. Serve as expert witness for plaintiffs.

*United States of America v. Jefferson County, et al.*; Civil Action No. CV-75-S-666-S, Jefferson County, AL. Race and sex discrimination in hiring practices. Employed by a defendant.

**AWARDS**

2002 *Outstanding Teaching Assistant Award*, The University of Georgia.

2001 *The Donald L. Grant Award*, in recognition of the most outstanding Master of Science Thesis in the Applied Psychology Program, The University of Georgia.

1998-1999 *United Parcel Service Graduate Fellowship* recipient, The University of Georgia.

**PROFESSIONAL ASSOCIATION MEMBERSHIP AND SERVICE**

Academy of Management, Member

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**GRADUATE CURRICULUM, THE UNIVERSITY OF GEORGIA**

Statistics in Psychological Research (PCYC 6410)

Advanced Experimental Psychology (PCYC 6420)

Applied Regression Methods (PCYC 6430)

Multivariate Analysis (PCYC 8990)

Psychometrics (PCYC 6250)

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Individual Differences (PCYC 6530)

Cognitive Psychology (PCYC 6630)

History of Psychology (PCYC 6180)

Industrial Psychology (PCYC 6140)

Organizational Psychology (PCYC 6140)

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Work Teams (PCYC 8980)

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Organizational Behavior (MGMT 9820)

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**SELECT TECHNICAL REPORTS** (Have co-authored more than 200 technical reports including validation reports, procedures manual chapters, and organizational effectiveness reports.)

- Allman, R., & **Brink, K. E.** (2007). *Content Validation Report: Police/Sheriff's Captain (6005/6035/6235) Promotional Examination*. The Personnel Board of Jefferson County, Alabama.
- Allman, R., & **Brink, K. E.** (2007). *Job Analysis and Minimum Qualifications Content Validation Report: Deputy Director of Roads & Transportation (3170)*. The Personnel Board of Jefferson County, Alabama.
- Allman, R., & **Brink, K. E.** (2007). *Job Analysis and Minimum Qualifications Content Validation Report: Hospital Maintenance Superintendent (8687)*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2007). *Content Validation Report: Police/Sheriff's Sergeant (6033/6233) Promotional Examination*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2007). *Job Analysis and Minimum Qualifications Content Validation Report: Cemetery Supervisor (8815)*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2007). *Job Analysis and Minimum Qualifications Content Validation Report: Environmental Chemist (7353)*. The Personnel Board of Jefferson County, Alabama.
- McMahan, L., & **Brink, K. E.** (2007). *Content Validation Report: Police Chief (6091/6092/6093) Examination*. The Personnel Board of Jefferson County, Alabama.
- McMahan, L., & **Brink, K. E.** (2007). *Job Analysis and Minimum Qualifications Content Validation Report: Administrator Outpatient Care (7881)*. The Personnel Board of Jefferson County, Alabama.
- Sutton, M., & **Brink, K. E.** (2007). *Content Validation Report: Police/Sheriff's Lieutenant (6034/6234) Promotional Examination*. The Personnel Board of Jefferson County, Alabama.
- Allman, R., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: County Property Manager (3674)*. The Personnel Board of Jefferson County, Alabama.
- Allman, R., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Director of Housekeeping (9179)*. The Personnel Board of Jefferson County, Alabama.
- Bourgeois, E., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Clinical Counselor (7570)*. The Personnel Board of Jefferson County, Alabama.

- Bourgeois, E., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Education/Training Manager (7674)*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2006). *Content Validation Report: Medical Clerk (0044) Examination*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Disease Intervention Program Manager (7367)*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Hydrologist (7333)*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: International Program Manager (7352)*. The Personnel Board of Jefferson County, Alabama.
- Keshavan, D., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Pharmacy Technician (7903)*. The Personnel Board of Jefferson County, Alabama.
- McMahan, L., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Chief Operations Officer-Cooper Green Hospital (7886)*. The Personnel Board of Jefferson County, Alabama.
- McMahan, L., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Director of Customer Services and Health Plans (7850)*. The Personnel Board of Jefferson County, Alabama.
- McMahan, L., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Director, Office of Senior Citizens Services (2369)*. The Personnel Board of Jefferson County, Alabama.
- McMahan, L., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Parole & Probation Administrator (2347)*. The Personnel Board of Jefferson County, Alabama.
- McMahan, L., & **Brink, K. E.** (2006). *Job Analysis and Minimum Qualifications Content Validation Report: Social Services Coordinator (2388)*. The Personnel Board of Jefferson County, Alabama.
- Personnel Board of Jefferson County. (2006). *Storm Water Management Authority Organizational Structure Review & Recommendations*. Birmingham, AL: Author.
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